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## ENTERPRISE SYSTEMS USE: TOWARDS A STRUCTURAL ANALYSIS OF ENTERPRISE SYSTEMS INDUCED ORGANIZATIONAL TRANSFORMATION

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### ABSTRACT

Enterprise systems (ES) are industry-specific, customizable software packages that integrate information and business process in organizations. Despite the advantages associated with implementing ES, their success has been mixed. This has attracted the interest of researchers and resulted in a proliferation of literature on implementation. However, the extant ES studies lack a theoretical framework for the examination of ES use and its implications for change in organizations. We seek to bridge this research gap by proposing a theoretical framework for change induced through ES use. This paper contributes to theory in two areas. First, by analytically separating the notions of structure, institution, and organization, we illustrate a consistent application of Giddens' structuration theory to ES use. Second, we develop a structural model of ES-induced change that explicates the relationship between specific characteristics of ES and the nature of change occasioned through their use by human agents within a historically shaped organizational context. Towards this objective, we distinguish ES from other information systems. Implications for practitioners and researchers are presented.

**Keywords:** Enterprise systems, IT-induced change, organization theory, situated technology use, structuration theory

### I. INTRODUCTION

Enterprise systems (ES) represent a category of information systems that has gained momentum and widespread use since the 1990s. ES are industry-specific, customizable software packages that integrate information and business process in organizations [Markus and Tanis 2000; Rosemann and Watson 2002]. Due to the scope, complexity and risks associated with ES, they are fundamentally different from other information systems (IS), requiring significant organizational investments in terms of technology, time, training and human resources. This paper adopts Markus and Tanis's [2000] and Davenport's [2000] view of ES as encompassing application software such as enterprise resource planning (ERP), customer relationship management (CRM), sales force automation (SFA), knowledge management (KM), and product

configuration packages. Companies often view such ES as a panacea for fragmented information, incompatible legacy systems, and outdated inefficient processes.

Despite the advantages associated with ES, the success of such systems is mixed [Stefanou 2000]. According to Davenport [1998], the biggest problems associated with ES are organizational in nature. Businesses underestimate the importance of change management [Appleton 1997], project planning [Scott and Vessey 2000] and strategic clarity [Davenport 2000]. Such publicized failures have attracted the interest of researchers, and resulted in a proliferation of literature on critical success factors for successful implementation of ERP systems [Holland et al. 1999; Sumner 1999; Nah and Lau 2001]. However, there is a gap in the extant ES literature, in that these studies lack a theoretical framework that adequately explains the occurrence of particular project and business outcomes [Robey, Ross, and Boudreau 2002]. Further, while ES implementation has received much attention in the literature, *ES use*, where much of ES-related issues are manifested organization-wide, is often neglected. In this context, we hope to highlight some important impacts on organizations as a result of ES use and provide some directions for further research in this important domain.

In this paper, we utilize Giddens' [1976, 1979, 1984] structuration theory to develop a model of ES-induced change that explicates the relationship between specific characteristics of ES and the nature of change occasioned through their use by human agents within a historically shaped organizational context. This view of change through use is consistent with Orlikowski and Barley's [2001] argument that "adequate accounts of technological change require hybrid explanations that weave together human action and choice, the functions and features of specific technologies, and the contexts of technology's use in a way that attends to the micro-dynamics of situated practice" (Pg. 151). We take the cue from Weick and Quinn [1999] and adopt the perspective of ES in the context of the changing organization. In doing so, we acknowledge the role of continuous change in shaping an organization, and concur that organizations possess a double nature whereby they are sites of continuously changing human action while simultaneously representing the form that results through the patterned unfolding of such human action [Tsouskas and Chia 2002]. Structuration is particularly amenable to explaining technology's potential to induce change since it is consistent with the continuously evolving view of the organization, incorporates a mixed level of analysis, and accounts for unanticipated changes. Also, structuration helps clarify the ontological nature of technology by bridging the subjective and objective dimensions [Orlikowski and Robey 1991].

In formulating a theory of ES-enabled change, we aspire to illustrate the difference between ES and traditional information technologies in their relationship with change. Accordingly, this paper reviews extant literature to present a picture of technology that encompasses its material and social dimensions. By drawing on recent literature on structuration, the distinguishing characteristics of ES are implicated in a structural analysis of the systems, which in turn lays the foundation for a structural model of ES-induced change. The objective of this research is to present a theoretical framework through structuration to explain the "black box" of ES-induced organizational change as a consequence of the *use* of these systems.

Toward the above objective, we identify the distinguishing characteristics of ES that differentiate them from other systems in Section 2. Further, we separate the artifact from its use, thus applying structuration consistently without embedding structures in technologies so that we may consider the implications of ES use. In section 3, we introduce the structural model of technology and change, and in section 4 we present our methodology within organizations, and selection of secondary dataset. The salient tenets of Giddens' [1976, 1979, 1984] structuration theory lay the foundation to our discussions on a structural viewpoint of ES use in section 5. Following that, we develop a structural model of ES-induced change and formulate propositions in section 6. The paper concludes with a discussion of its theoretical contributions and implications for practitioners and researchers.

## II. ENTERPRISE SYSTEMS AND TRADITIONAL IS

ES have evolved from internal standard inventory control (IC) packages to encompass material requirements planning (MRP) and manufacturing resource planning (MRP II), and further expanded to include other enterprise processes such as sales and order management, purchasing, financial and managerial accounting, and human resource management [Kumar and Hillegersberg 2000; Klaus et al. 2000]. Enterprise systems are packaged, off-the-shelf software solutions that embed industry-wide best practices to integrate a business's functions and processes into a single, comprehensive framework [Markus and Tanis 2000]. Currently, ES literature mostly focuses on implementation issues and very few studies exist on ES use. Yet, it is during use that many ES problems are manifested, even if they might have originated from implementation [Markus and Tanis, 2000]. Due to the dearth of research on ES use, we draw on the literature on ES implementations for related findings. As ES implementations typically unfold over a long period of time, comments related to ES use do surface in ES implementation reports. Consequently, during implementation stage, the initial patterns of usage emerge. As early patterns of usage are known to congeal and become resistant to change [Tyre and Orliwoski 1994], they form an interesting subject for researchers seeking an understanding of ES use in general.

Half of all ES projects fail, largely due to an underestimation of the changes necessary in the organization [Appleton 1997]. Risks facing an organization during ES implementation, combined with low productivity which is typically present during and immediately after ES implementations, may even contribute to bankrupting an organization [Scott and Vessey 2002; Hitt et al. 2002]. Much of the underestimation of ES implementation complexities may perhaps be attributed to a failure in recognizing the significant differences between ES and traditional IS [Markus and Tanis 2000].

ES, by design, support a process-oriented view of the enterprise [Nah and Lau 2001]. They streamline the flow of information across traditional business functions by utilizing a common IT infrastructure [Newell et al. 2003]. Traditional IS usually cater to functional units independently, potentially with disparate platforms, and hence are not integrated. In contrast, ES entail tight interdependencies among a firm's functional units [Ross and Vitale 2000], bringing together all activities so that they operate as a whole [Klaus et al. 2000; Robinson and Wilson 2001; Ross and Vitale 2000] with real-time data [O'Leary 2000].

Due to the integrative nature of ES, implementing ES is a highly complex task [Bunker 2000] which entails complications and risks that are not common to traditional IS [Markus and Tanis 2000; Sumner, 2000]. For instance, integration means standardization of data across functional units. Indeed, an enterprise system is noted to impose "its own logic on a company's strategy, organization, and culture" [Davenport 1998, Pg. 121], and often, ES users must not only be trained to use the software, but also to understand the overall logic of the system. As a result, ES implementations often end up late, over budget [Gibson et al. 1999; Scott and Vessey 2000] or in failure [Davenport 1998]. Further, the role of ES itself could evolve in the context of e-business [Pan and Tan 2005].

In their approach, ES have been closely linked with business process redesign (BPR), although there is some debate as to their sequence in implementation [Esteves et al. 2002; Bancroft et al. 1998], thus affecting users with process and system changes. Processes in ES, by virtue of the best practices embedded in them [Krumbholz and Maiden 2001], are often potentially in conflict with an organization's existing practices. This conflict can be resolved by either tailoring the ERP software to suit the existing business processes, or by reengineering the organization's processes to adopt the best practices in the software, with minimal customization of the latter [Al-Mudimigh et al. 2001]. However, another school of thought advocates minimal customization [Holland et al. 1999; Bancroft et al. 1998] to avoid the high cost of customization and complexity. Recent technical developments such as componentization and enterprise frameworks are attempts to mask some of this complexity by allowing ES to be tailored across different areas of the business in a more effective manner [Fan et al. 2000].

According to Davenport [2000], reengineering results in changes in an organization’s strategy, structure, and culture, and the behavior of its workers. Davenport [1998] states that such changes tend to be paradoxical: ERP promotes more flexible and flatter organizations through increased information sharing while centralization of control over such information and standardization of processes (according to the software) tend to promote command-and-control organizational structures that stifle innovation. ES thus impact employee roles by rendering tasks more broad-based, necessitating a shift in the nature of skills and knowledge possessed by the individual [Davenport 2000]. Some studies illustrate how individual knowledge becomes more divergent due to ES as subject specialists need to know more about other business areas [Baskerville et al. 2000; Sia et al. 2002].

Numerous studies indicate that efficiency is a major motivation for ES use [Davenport 1998; Nah and Lau 2001; Newell et al. 2003], derived from reduced operating costs and better productivity through information sharing and the redesign of business processes. Another stream of literature reports that primary incentives should be strategic in nature, providing competitive advantage [e.g., Davenport 2000]. Other motivations include the organizational need for a common technology platform, BPR, improved data visibility, enhanced decision-making capabilities and better customer responsiveness through a unified view of the organization [Ross and Vitale 2000; Markus and Tanis, 2000; Pan and Lee 2003]. Hence, making standardized real-time data visible across the entire organization is a significant advantage offered by ES compared to traditional IS. Table 1 summarizes these key characteristics of ES reported in the literature.

Table 1. Summary of Key ES Characteristics and Related Literature

ES Category	ES Literature	Summary
<b>System Characteristics</b>		
Multiple Functional Modules	Davenport (2000); Markus and Tanis (2000); Kumar and Hillegersberg (2000); Klaus et al. (2000); Light et al. (2001)	Enterprise systems include applications software such as enterprise resource planning (ERP), customer relationship management (CRM), sales force automation (SFA), knowledge management (KM) and product configuration packages.
Integrated	Markus and Tanis(2000); Rosemann and Watson(2002); Klaus et al. (2000); Robinson and Wilson (2001); Ross and Vitale (2000); Hanseth et al. (2001); Parr and Shanks (2000); Light et al. (2001); Gattiker and Goodhue (2000)	Enterprise systems are industry-specific, customizable software packages that integrate information and business process in organizations.
Complex	Davenport (2000; 1998); Markus and Tanis (2000); Bunker (2000); Gosain (2004); Robey et al. (2002)	Complex systems that involve organization-wide resources and require many changes.
Strategic	Davenport (2000); Hanseth et al. (2001); Fan et al. (2000); Scott and Vessey (2002)	Supports organizational strategy, even becoming a necessity to compete globally.
Business Logic	Davenport (1998); Krumbholz and Maiden (2001); Scott and Kaindl (2000); Gosain (2004)	Imposes its own logic on the organization; developed based on industry best practices, rather the organization’s unique business practices.

Workflow	Nah and Lau (2001); Kumar and Hillegersberg (2000); Lee and Lee (2000); Klaus et al. (2000)	ES provide a process view of the organization, integrating cross-functional users.
Technology	Newell, et al(2003);Fan et al. (2000); Sprott (2000); Kumar and Hillegersberg (2000)	Common IT infrastructure and component-based system architecture.
Data	Davenport (1998); Markus and Tanis (2000); O’Leary (2000); Connoly (1999); Ross (1999)	Standardized data, coding schemes and procedures to enable organization-wide flow of real-time data.
<b>Implementation &amp; Organizational Impacts</b>		
Motivation	Nah and Lau (2001); Davenport (1998); Newell et al. (2003); Bhattacharjee, (2000); Ross and Vitale (2000); Davenport (2000); Al-Mudimigh, Zairi and Al-Mashari (2001); Connoly (1999)	Organization wide efficiency, flexibility, visibility of data across the organization, integration of disparate systems and strategic reasons.
Customization	Holland et al. (1999); Bancroft et al. (1998); Glass (1998); Fan et al. (2000); Davenport (1998); Talbert (2002)	Some studies recommend minimal customization since ES are complex software, though options to customize and reprogram parts of ES exist. Others recommend greater customization to suit organizational idiosyncrasies.
Success	Stefanou (2000); Larsen and Myers (1999); Davenport (2000); Markus et al. (2000); Hanseth et al. (2001)	Success depends on when it is measured, multiple measures, metrics, and the early identification of problems. ES also improve cooperation and coordination across multiple functions.
Failure	Scott and Vessey (2000; 2002); Davenport (1998); Appleton (1997); Markus and Tanis (2000); Gibson et al. (1999)	Failure often results from underestimating changes and the complexities of ES implementations; ES projects often run late and are over budget.
Critical Success Factors	Holland et al. (1999); Sumner(1999); Nah and Lau,(2001); Dong (2001); Bancroft et al. (1998); Somers and Nelson (2001); Falkowski (1998); Bingi et al. (1999); Gefen and Ridings (2002); Parr and Shanks (2000); Robey et al. (2002); Milford and Steward (2000); Holland and Light (1999); Kawalek and Wood-Harper, 2002	A variety of success factors are identified, including aligning strategy and business needs, project management, reengineering to fit ES logic, change management, training, user involvement, perception and team responsiveness.
Implementation Models	Robey et al. (2002); Volkoff (1999); Markus and Tanis (2000); Ross and Vitale (2000); Lee and Lee (2000); Parr and Shanks (2000); Davenport (2000);	Phase models of four to five stages identify, customize, implement and maintain ES implementations.

Change Management	Esteves, Pastor and Casanovas (2002); Bancroft et al. (1998); Davenport (2000); Al-Mudimigh, Zairi and Al-Mashari (2001); Soh et al. (2000); Besson and Rowe (2001)	Discussion of the importance and place of emergent and planned change management, considering the organizational changes required to implement ES and managing cultural changes in organizations.
User Knowledge	Davenport (2000); Baskerville, Powlowski and McLean (2000); Sia et al. (2002); Robey et al. (2002); Soh et al. (2000); Eriksen et al. (1999); Askenas and Westelius (2000); Baskerville et al. (2000)	Broad-based knowledge derived from having to work with multi-functional teams. Some studies reflect concerns for assimilation of knowledge, and low knowledgeability.
Post-implementation	Sumner (2000); Shang et al. (2002)	Discussion of user needs in the post-implementation phase and the benefits of ES use.

From the above ES literature review, we may delineate areas where ES extend beyond or significantly differ from other information technologies. As the summary in Table 2 shows, we may align the differences conceptually with the various established areas in IS research [Markus and Tanis 2000]. As a fundamental difference between traditional IS and ES is the organizational change that ES induce, examining ES use in organizations may provide us with new research directions to study organizational change. In the following sections, we consider the distinguishing characteristics of ES and use structuration theory as the conceptual basis for a model of ES-induced change. We first consider the relevance of structuration theory to our study.

### III. STRUCTURAL MODEL OF TECHNOLOGY AND CHANGE

Technology represents one of the most widely researched factors that contribute to shaping organizations. The earliest attempts to explain the role of technology in organizations were made by contingency theorists [Woodward 1965], and contradicted by subsequent studies [Robey 1977; Hickson et al. 1969; Kling 1980]. Treating technology as a contingency variable implies a causal link between the routineness of technology and the degree of formalization and centralization within a firm [Gerwin 1979]. Treating technology as a contingency variable is an illustration of the *technological imperative*, where technology is viewed as an exogenous force [Markus and Robey 1988] that exerts unidirectional influence on organizations and individuals. A key limitation of the technological imperative lies in its neglect of human agency in appropriating and possibly modifying technology [Orlikowski 1992].

A different line of thinking is the *organizational/strategic choice imperative*, which argues that technologies are subject to modification by humans. Technology thus becomes the dependent variable, with human actors exerting almost unlimited influence on the adoption and consequences of technology. According to Orlikowski [1992], such a perspective does not accept that technology is immutable; instead, it focuses on the way in which technology is influenced by the context and strategies of technology decision makers. Though strategic choice theories of technology consider the link between technologies and managerial intent, they suffer the same limitation of strategic choice theories of the organization in attributing too much weight to the actions of managers.

A third approach integrates the technological imperative and the strategic choice imperative. The *structural model of technology* explains change as a negotiated process between technologies and human agency within organizational environments [Orlikowski and Robey 1991]. Numerous researchers have used structuration theory to explain the relationship between technologies and change [Barley 1986; Orlikowski and Robey 1991; Orlikowski 1992; Jones and

Table 2. Comparison of Traditional Information Systems and Enterprise Systems

System Characteristics	Traditional Information Systems	Enterprise Systems
Strategy	Lower organizational scope, with impacts limited to specific functional units.	High complexity requiring organization-wide resources that impacts productivity.
Flexibility	High flexibility due to lower integration with cross-functional processes.	Low flexibility due to greater integration of business processes.
Scope	Integrates selected functions within or across business functions.	Integrates all or most business processes in the organization. Modules encompass individual functional units. Seen as a solution for fragmented information, incompatible legacy systems, and outdated inefficient processes.
Business Logic	Systems developed to suit processes, or packaged software to suit some processes.	Best practices built into ES are adopted in the organization, or customized with the system being configured to suit organizational processes.
Development	Often developed in-house, or by vendors after gathering requirements from functional units.	Packaged software often developed by vendors based on knowledge of industry best practices.
Driver of Adoption	IT-driven adoption of software, with a greater role for organizational IS teams providing technology-based solutions.	Business driven adoption of software, with lesser role for organizational IS teams and greater role for external consultants or vendors.
Complexity	Low to medium in most projects due to the limited scope.	High due to greater integration and standardization, with many processes and cross-functional implementation.
Deployment	Myriad systems developed to different processes.	One or more packages which suit specific functional units.
Industry Commonality	Individual systems that are not too common across industry verticals.	Increasingly common across industry verticals.
Risk	Low risk due to lesser demand on organizational resources. Failure and success are variedly defined, but risk of failure is low relative to ES.	Higher risk due to greater demand on organizational resources. Consequently, most projects are curtailed during implementation or are prone to fail.

Nandhakumar 1993; Walsham and Han 1993; DeSanctis and Poole 1994; Karsten 1995; Orlikowski 1996; Orlikowski 2000]. Barley [1986] uses tenets of structuration (notably, the duality of structure) by treating structure both as a form and as a process. In his observations of the effects of CT scanners on the social order of radiology departments, technology is treated as an *occasion* for structuring, revising the traditional assumption that technologies *cause* structural



change. Technology is treated as a social object whose meaning varies according to differences in usage contexts. This perspective supports the unanticipated outcomes of technology by noting that identical technologies can lead to different structural outcomes in different situations [Barley 1986].

The above perspective of technology also integrates the effects of technology across multiple levels of analysis. Barley's [1990] treatment of the structure-technology alignment via actors' roles and relationships within networks is one such study. Utilizing negotiated-order and role theories, Barley argues that a technology's material aspects occasion changes in non-relational aspects of roles, which in turn, cascade to these roles' relational elements. By conceiving structure as a pattern that emerges from relationships between actors (relational aspects of roles), changes in role relations can be directly linked to structural change [Barley 1990].

Discussing the impact of technology on structural change, Burkhardt and Brass [1990] illustrate that the occurrence of stability or change is contingent upon the power and centrality (within an organization's social network) of the early adopters of technology. Their work attributes a greater role to human agency through network centrality and power of actors. These are aspects of the relational elements of roles since the concepts are only relevant relative to other actors. The central hypothesis of their paper is that early adopters of a technology experience an increase in their network centrality and power following the introduction of the new technology. Burkhardt and Brass [1990] go on to claim early adopters who are central and powerful tend to maintain and reinforce existing patterns, whereas peripheral and less powerful early adopters tend to alter the status quo. Their work illustrates the ability of human agency to exhibit a variety of structures through technology.

While Barley's [1986, 1990] papers significantly advance our understanding of the relationship between technologies and structural change, they do not indicate the potential (if any) for users to modify technologies through their interactions with them. Orlikowski [1992] addresses this concern by proposing a structurational model of technology that has, as its building blocks, the *duality of technology* and the *interpretive flexibility of technology*. The duality of technology nullifies the previous dichotomy of technology as an external physical object or a social construct [Orlikowski 1992]. Technology has certain material properties built into it by its designers that constitute structures embedded in technology, *and* is also shaped through social interactions with users who attach different meanings to it, depending on the context of use. A direct corollary of the principle of duality is technology's inherent interpretive flexibility, which is the degree to which users of a technology are involved in its physical and social construction and use [Pinch and Bijker, 1987]. Through technology's interpretive flexibility, interactions with technology develop over time and are institutionalized [Orlikowski, 1992].

The discussion above allows a definition of technology that encompasses its specific (physical/material) characteristics while at the same time being open to and influencing human action. Orlikowski and Barley [2001, Pg. 149] shed light on the importance of bridging the gap between materialism and agency: "Technologies are simultaneously social and physical artifacts. Consequently, neither a strictly (social) constructionist nor a strictly materialist stance are adequate for studying technologies in the workplace. Elements of both perspectives are required." The material and social dimensions of technology are illustrated in Figure 1. Following this model, we examine the characteristics of ES and their influence on human action in the sections following.

#### IV. RESEARCH METHODOLOGY

There is a growing interest among researchers in studying ES in the IS literature, though some researchers consider the quantum of such research efforts low considering the size and value of the ES market [Esteves and Pastor 2001]. Among the articles on ES, the majority of articles discuss implementation projects and related issues [Esteves and Pastor 2001]. Post-implementation data on ES is still lacking in the academic literature discussing ES [Hitt et al

2002]. In this paper, we discuss some implications for post-implementation impacts of ES on organizational change. However, due to the lack of in-depth qualitative articles discussing the use of ES, this research relies on selected articles that can serve as sources of information on the impacts of ES use in organizations.

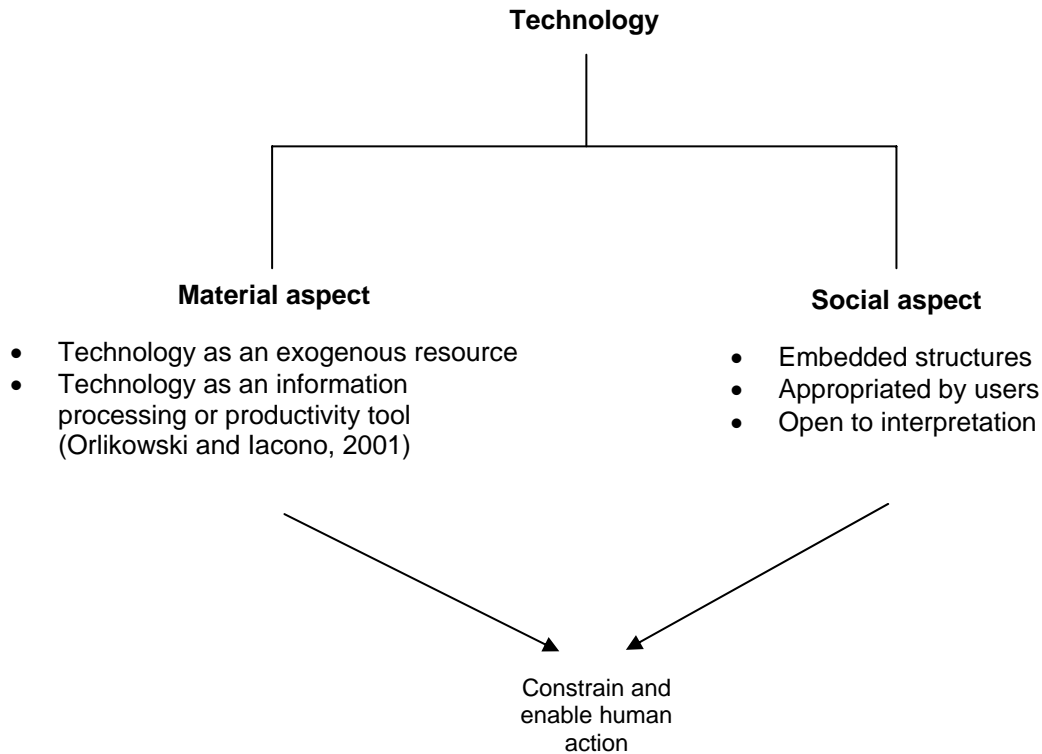


Figure 1. Dimensions of Technology

A search of several IS journals was first conducted, identifying ES related articles. Next, articles not reporting qualitative data, or articles that did not discuss user perspective, or articles that did not report on completed implementations were discarded. This stage ensured that the articles finally selected contribute some data on user perspectives in ES. Further, due to the long implementation periods for ES, often some data on ES use may be gleaned from such studies. Finally, articles that did not report contribute direct quotes from users, which may be understood and interpreted in the context of ES use were discarded. This step made it possible to extract secondary data without losing the context in which the original authors reported such data. The articles used in this research are listed in Appendix A. In the next stage, secondary data was examined in the context of the structurational model, identifying themes that relate to the modalities of structuration. The analysis relates data on ES with the impacts on change in relation to the modalities of structuration. In the next section, we elaborate on some key concepts that are relevant to the discussion on ES use and change in organizations.

**V. STRUCTURATIONAL ANALYSIS OF ENTERPRISE SYSTEMS**

In the preceding sections, we discussed the structurational model of technology to explain change as a negotiated process between technology and human agency. Structuration theory underpins this perspective, providing a mechanism to study the ongoing interaction between technology and human action at multiple levels in an organization. Several approaches may be employed to examine this interaction between technology and human action. However, in the context of this study structuration theory is used to examine the interaction. Structuration theory

can be a useful paradigm to examine culture, expressed as conceptualization of shared symbols, norms and values [Walsham, 2002]. In the context of ES use, where the individual is implicated centrally in relation to their interaction with technology, we believe structuration theory is one approach to theorizing in this domain, albeit it may not be the only available approach.

Giddens proposed structuration theory [1976, 1979, 1984] in response to a debate on the subjective and objective nature of social reality, emphasizing the importance of both subjective human action and objective institutional properties. Giddens proposed duality of structure, where structure is created through human action while also shaping human action. Structuration theory has been applied extensively in organizational studies. Giddens' Structuration Theory [1976, 1979, 1984], and specific applications of structuration to technology [Barley 1986; Orlikowski and Robey 1991; Orlikowski 2000] comprise our conceptual basis for a model of ES-induced change. Structuration has been used for the study of ES implementation [Volkoff 1999], and combined with behavioral models for the investigation of usage [Pozzebon 2000].

In this section, we identify some key concepts from Giddens' [1984] structuration theory, maintaining that it is crucial to retain the original definitions of structure. We proceed by identifying how reconstructions of the theory to accommodate technology, by Orlikowski [1992] and DeSanctis and Poole [1994], embed structure in their treatment of technological artifacts. We adopt Orlikowski's [2000] view of technologies-in-practice, and view user interactions with ES as enactments. In sum, these discussions lay the foundation for showing how ES differ from traditional IS in the context of organizational change.

## **DEFINING ORGANIZATIONS, INSTITUTIONS, AND STRUCTURES**

For the purposes of this paper, it is important to differentiate between the notions of organization, institution, and structure. Consistent with structuration theory, organizations may be viewed as a collective of people enacting patterns of behaviors. Weick [2001] concurs with the definition of organization based on Giddens [1984] by Westley [1990; Pg. 339] as "a series of interlocking routines, habituated action patterns that bring the same people together around the same activities in the same time and places." This view of organizations as "organizing" emphasizes the enactment of structures by agencies within the organization. Weick [1979] describes organizing as "a consensually validated grammar for reducing equivocality by means of sensible interlocked behaviors."

An institution is defined as "sets of overarching principles and practices that have the normative force of taken-for-granted assumptions or cultural blueprints for action" [Barley, 1990, Pg. 65]. According to Khalil [1995], institutions are conventions (formal and informal standards and norms) and paradigms (pre-existing schemes that guide humans). An institution thus represents persistent and concrete constraints on humans in an organization [Zucker, 1987] through its definition as "cultural blueprints for action." Such a persistent concrete constraint, however, does not put institutions beyond human action. Giddens [1979, Pg.96] regards institutions as "standardized modes of behavior." Giddens [1984] further explains institutions as practices that have the greatest time-space extension. Thus, human action shapes institutions, and institutions, as standard modes of behavior, in some form temper human action. This understanding of institutions is reflected as deeper structures in structuration theory, which is consistent with the objectives of social construction through human action over time. In the context of information technologies, such institutional influence is similar to Tyre and Orlikowski's [1994] observations of initial patterns of technology use congealing due to corporate pressure toward achieving productivity, and users' preference for stable and predictable technologies.

The definition of structure is derived from work in the social sciences by Giddens [1976, 1979, and 1984]. Structuration combines subjective and objective conceptions of organizations simultaneously through the duality of structure, conceiving human action as being enabled and constrained by structures, with the structures themselves being a consequence of historical actions. Structure is an abstract notion, comprising rules and resources that exist only as memory traces which are instantiated in human action [Giddens 1976]. Hence, structure cannot be

thought of as being embedded in artifacts or existing outside the realm of human action [Jones and Karsten, 2003]. Giddens [1984] identifies three dimensions of structure, which he calls structures of signification, domination, and legitimation. Actors draw upon existing structures of signification, domination, and legitimation through the modalities of interpretative schemes, resources and norms in their actions, which, in turn, serve to (re)produce these structures, as shown in Figure 2. The arrows in Figure 2 indicate the overlap of various structures and modalities. It must be noted here that the distinctions is for analytical purposes, and as illustrated in the example further on in this section, all these influences are enacted simultaneously as human agency interprets and enacts structures.

The modalities of structuration (interpretative schemes, facilities and norms) are institutionalized rules and resources that actors draw upon in their social interactions. However, modalities do not operate in a vacuum, but are influenced by historical and organizational contexts [Orlikowski and Robey, 1991]. The modalities are differentiated from structures and the engagement of the structures by human agency, and are represented by dotted lines in Figure 2. Thus, organizations are a composite of the structures informed by the environment in which they are enacted. Through their repeated enactment, they are reified. Giddens [1984; Pg. 180] notes that reification refers not to “thing-like” connotation, but “to the ‘facticity’ with which social phenomena confront individual actors in such a way as to ignore how they are produced and reproduced through human agency.”

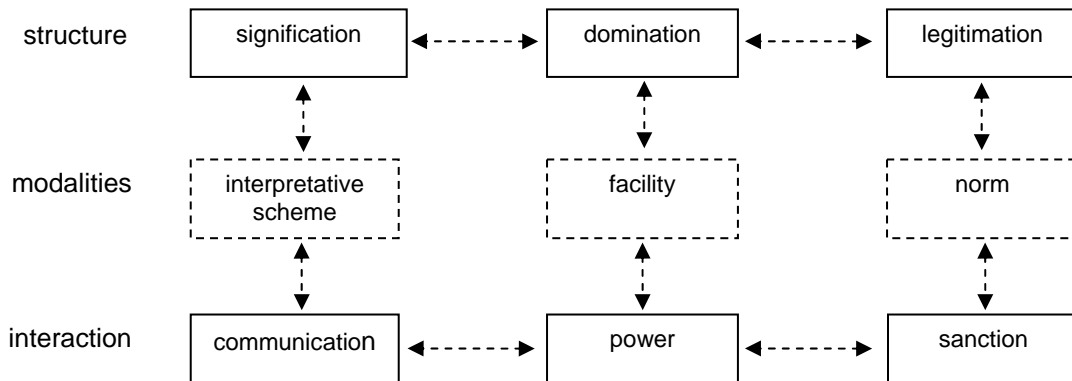


Figure 2. Dimensions of Duality of Structure (adapted from Giddens, 1984)

To understand this recursive relationship between action and structure through various modalities, we consider the example of ACRO [Volkoff et al. 2005], a manufacturing company with three plants around the world integrated through ES. The bill of materials (BoM) was previously maintained individually by the engineering department (EBoM) as per design, by the assembly division (ABoM) as per assembly, and by the sales group as per order (OBoM). ES integrated these three BoMs by generating ABoM and OBoM from EBoM. All users, through structures of legitimation, access ES to retrieve the relevant BoM. The design engineers continued to create the standard EBoM, drawing on structures of signification. Through their interpretive schemes, engineers drew on their knowledge of creating EBoM to enter their data into ES through structures of domination. However, norms required the engineers to enter details previously unnecessary that were specific to assembly or sales. At each instance, the engineers could choose to ignore assembly details and face sanctions from the management for not complying with the norms. In practice, incomplete details in BoMs disrupted assembly line and purchasing activities. This tight integration throughout the organization enforced process discipline on all users, since ES demanded accuracy. The users complied with ES use, abandoning various workarounds used earlier that “got the job done.” Through their repetitive enactment of sacrificing productivity in favor of accuracy, the users institutionalized new

structures, illustrating the duality of structuration and the organizational impact of enactments by individuals.

A pertinent question here is how structures, institutions, and organizations are linked. Human action can both transform and reproduce existing structures. To the extent that an agent acts in a manner consistent with these structures, the agent reproduces them. However, there is an omnipresent potential for agents to modify their actions due to reflexivity, thereby changing the structures they enact [Orlikowski 2000]. Returning to the illustration presented above, the design engineers could choose to continue to ignore assembly level details in EBoM while updating ES. That would change the signification structure with respect to BoM, rendering the ES-generated ABoM useless. According to Giddens [1984], the recursive reproduction of structures over time and space lends them a systemic nature. Repeated violations of structures of legitimation may become institutionalized over time. Thus, existing institutions are reinforced when the same structures are enacted across time and space, but there exists the potential for institutional change when modified structures are reenacted. In the example of ACRO, a new system upgrade might allow the assembly line staff to update ES with ABoM in place of the designers. In summary, routinized interactions between human actors result in the same structures being replicated, representing the institutionalized properties of organizations [Rose and Hackney 2003].

### ENACTING TECHNOLOGIES IN PRACTICE

Following the above discussion on structures, organizations, and institutions, we now consider the role of technological artifacts in the structuration process. Both adaptive structuration theory [DeSanctis and Poole 1994] and the structurational model of technology [Orlikowski 1992] consider structures as being embedded in technology. Jones and Nandhakumar [1993], Jones [1999], Jones and Karsten [2003] and Rose and Hackney [2003] illustrate the problem associated with such a perspective – that it dilutes Giddens’ theory by fixing one half of the duality in which action and structure are interlinked: If structure is abstract, it cannot exist in a physical artifact. In Giddens’ terms, structure is instantiated only in action; treating technology as embodying structures dilutes structuration theory by ascribing a material aspect to structure. An accurate incorporation of technology into the structurational perspective poses a challenge for researchers, in that they need to account for the material nature of technology without treating technology outside the duality of structure [Jones and Nandakumar 1993].

Orlikowski [1995] addresses this problem by proposing technologies-in-use as a means of conceptualizing technologies as material resources that become implicated in structuration only through their use by human agents. This view is extended in her “practice lens” for studying technology’s effects on organizations [Orlikowski, 2000], which distinguishes between technology as a material artifact and technology-in-practice, in the process bridging the gap between extant structurational theories of technology and Giddens’ [1984] sociological formulation of structuration. Orlikowski [2000] theorizes that technologies do not embody structures. Instead, structures are emergent in the sense that they are instantiated in the use of technological artifacts by actors. These structures are called technologies-in-practice [Orlikowski, 2000].

The view of structures as emerging in technology use also necessitates a change in the language describing human action. It is no longer accurate to refer to human actors as *appropriating structures* since appropriation conceives human action in terms of interaction with structures embedded in technology [Orlikowski 2000]. Appropriation assumes embedding of structures within technologies while structures constrain and enable human action. However, such a view of *embedded structure* in material technologies is a problem in the social construction of technology. This is because Giddens [1984] emphasizes that despite materiality, such phenomena are resources only when incorporated within the structuration process. This necessitates the view of structures as emergent rather than embodied in technologies. Thus, Orlikowski [2000] posits that humans *enact structures* in technology through their engagement with the material aspects of technology. Orlikowski’s [2000] definition of enactment is more general than that of Weick [1969]. Weick [1969; Pg. 70] uses enactment to refer to “the constituting of the environment by actors”

while Orlikowski [2000; Pg.425] uses “enactment” “in the conventional sense of ‘to constitute, actuate, perform’ (Oxford English Dictionary) or ‘to represent in or translate into action’ (Merriam-Webster Dictionary).”

In summary, we view technology use in organizations as enactments that are not inscribed in technological artifacts, but emergent in their use. Since enactments are also contingent on human action, this view of enacting structures combines the emergent view of change with enactment of technologies through human action. Following the discussion above, we will use “technology use” to imply “technology-in-practice” as well. Further, following our discussions in section 2 distinguishing ES from traditional IS, we apply technologies-in-practice equivalently to the instantiation of the ES through use in organizations. Hence, ES-in-use and ES-in-practice refer to the enactment of structures by users, where they engage the material aspects of ES through use. In Section 6, we will use this definition of structuration of enacting technology use to draw propositions on ES use.

### ES AND CONSTRAINTS ON HUMAN ACTION

In the preceding discussions, we implicated technology-in-practice with enactments of structures in organizations. Though humans can freely interpret and modify the structures they enact, there are some constraints on human action. In this section, we describe the nature and source of such constraints to identify the same in the context of ES.

Through the idea of constraints, we intend to explore ES as limiting users in some ways within organizations. Giddens [1984] discusses three types of constraints on human action, namely, *material constraints*, *sanctions*, and *structural constraints*. *Material constraints* arise from the limitations of the material aspects of artifacts, such as our body (bearing in mind the enabling and constraining nature of material aspects). For example, standardized data formats in ES constrain some users while updating non-conforming data. *Sanctions as constraints* refer to power relations, where human action acquiesces or complies with certain expectations. For example, Davidson [2000] reports a case where clinical administrators give physicians ready access to administration-sanctioned orders, thereby influencing physicians’ orders. Finally, *structural constraints* refer to the contextuality of action, given the structures of the larger society. For example, users are often under pressure to comply with ES use despite limited knowledge of the system’s role in the entire organization [Sumner, 2000].

Considering our discussion above on technologies-in-practice and the nature of constraints in the context of structuration, we now associate technological artifacts with technological constraints. (Note that we use the term constraint here for consistency; in reality, technologies both constrain and enable action.) Technology-as-artifact comprises the material characteristics and properties crafted by its designers that reflect their assumptions about the world at a particular instance of time [Orlikowski, 2000]. These characteristics impose boundaries on how technology is used, and hence, are a source of constraint on human action. Such a constraint is still consistent with structuration; as Giddens [1984, Pg. 175] notes, “identification of physical constraints provides no particular fuel to defend a materialist interpretation of social life.”

The second source of constraint arises from the use of the technology. In enacting technologies-in-practice, users are influenced by enactments that are deemed legitimate by other agents (who shape users’ interaction with technology), such as managers, reflecting power relations embedded in standardized modes of behavior. Giddens [1984; Pg. 176] notes: “Power relations are often most profoundly embedded in modes of conduct which are taken for granted by those who follow them, most especially in routinized behavior, which is only diffusely motivated.” Orlikowski et al. [1995] refer to such influence of third parties on an individual’s routinized behavior of technology use as the metastructuring of technology in different use contexts. Thus, the agency enacting a technology-in-practice is constrained in some ways. Gosain [2004] explains an enterprise system as a duality that is the product of institutional processes that further constrains its users to preserve institutional rules. Such constraints impact the enactment of some structures in organizations by shaping human action to a limited extent, though human

action may still result in deviant enactments. We explore this aspect of ES further in our model in Section 6.

**ES AND OPACITY OF ACTION**

One significant and distinguishing feature of ES is their highly integrated nature by design and use. Integration implies that enactment in one part of the organization impacts other parts of it. Given that ES impose various constraints on users (as discussed in Section 5.3), and that human agency is capable of enacting deviant behaviors at any instance, their ability to penetrate these constraints becomes a pertinent issue. We use Giddens’ [1984] notion of “opacity of action” to examine why users may not be in a position to break free from enacting certain structures in action. (Note that this inability in no way diminishes the ability of users to enact any use with ES, as with the constraints discussed above.) To contextualize the discussion, we first consider the notion of interpenetration within the broader concept of structuration with an example.

Structuration is the enactment of structures as interpreted by human agency through various modalities. However, this ability to interpret and act is not unlimited. We begin by noting that Giddens’ modalities do not exist independently but only through the enactment of each of the structures. However, such enactment of structures may happen in multiplicity i.e., action by an agency may enact more than one structure at a time. Termed *interpenetration of structures*, this multiple enactments refers to the production and reproduction of many structures in the same action system [Poole et al. 1985]. Two forms of interpenetration of structures are *mediation* and *contradiction* [Poole et al., 1985].

Table 3. Summary of Interpenetration of Structures

Interpenetration of Structures	Simultaneous enactment of multiple structures
Mediation of Structures	One structure <i>mediates</i> the enactment of another structure. (e.g., Physicians’ desire for ease of system use mediates issuing standard orders through ES rather than using non-standard orders. One practice takes precedence over another, in this instance, as desired by the administrators.)
Contradiction of Structures	One structure <i>contradicts</i> the enactment of another structure (e.g., ES often impose their own logic on an organization, unlike traditional IS, which are expected to align themselves with the goals of the adopting organization.)

For illustration, we consider the case of a clinic where system designers believe physicians usually prefer ready choices of standard orders rather than cumbersome procedures to create non-standard orders [Davidson 2000]. Hence, physicians’ preference for ease in selecting orders in a system complements the desire of clinical administrators to influence their orders. Here, ease of use *mediates* issuance of sanctioned orders while non-standard orders are discarded or seldom used. Next, we consider Davenport’s [1998] observation that ES impose their own logic on organizations. Glass [1998] notes the contradiction that at a time when IS are generally expected to align with the goals of the adopting organization, ERP often imposes its own processes on the organization. In the above example, if the physicians continue to order non-standard prescriptions despite the cumbersome procedure, their enactment may cost the clinic in terms of the time taken to create orders in an efficient manner. The physicians’ enactment would *contradict* that of the clinical administrators by not conforming to and affecting the efficiency of system use. We summarize the discussion on the two forms of interpenetration and the example above in Table 3.



Since ES are complex highly integrated systems, examining interpenetration of structures provides useful insights into ES-in-practice. ES, as carriers of institutional logic, strongly influence the modalities that govern users' enactment of ES-in-practice [Gosain, 2004]. The notion of technology impacting modalities of structuration is not new, as illustrated in Orlikowski and Robey [1991]. However, ES, due to their organization-wide scope, differ significantly from other information technologies in their interpenetration of multiple structures. ES thus affects the "knowledgeability" of agency stemming from their complexity, tight integration, and lack of visibility for individual users across the organization, presenting knowledge barriers in the learning of ES use [Robey et al., 2002; Sumner, 2000]. Giddens [1979] explains that in enacting structuration, actors are knowledgeable about the structural framework they draw upon to produce their action. However, penetration of this knowledgeability is typically limited by boundaries of action as we have discussed. Such effect on knowledgeability is known as "opacity of action," which refers to "the low degree of penetration by actors of the conditions of their action and its involvement in the reproduction of social systems" [Giddens, 1979; Pg.144].

We have now elaborated on the concepts necessary to discuss a structural model of ES-induced organizational transformation. We now apply structuration theory to study the impacts of ES use within organizations, and the resultant effect on change. The model and its associated propositions are explicated in the next section.

## **VI. STRUCTURATIONAL ANALYSIS OF ORGANIZATIONAL TRANSFORMATION INDUCED BY ENTERPRISE SYSTEMS USE**

ES are used within historically shaped organizations, which have preexisting institutional features and modalities of structuration. The nature of ES in use, their influence on human action, and the ongoing emergent enactments of ES use impact organizations. In this section, we relate the realms of the structuration model to characteristics of ES-in-practice. We discuss the individual structures of the realms and their modalities in the context of ES use, and illustrate with examples of ES use from the literature. As we have noted, given the lack of literature on ES use, we will also rely on use observations of ES use from in-depth ES implementation case studies. Figure 3 summarizes the propositions we derive by relating structuration and ES-in-practice.

### **REALM OF STRUCTURES: REIFYING INSTITUTIONAL FORCES**

Giddens [1979; 1984] identifies institutions as deeper structures, which have gained currency to be held as shared practices and norms. We propose here that through ES-in-practice, ES as integrated enterprise-wide information systems serve to constrain patterns of organizational practices, thus sanctioning some enactments while ignoring others. Organizational practices gain currency by way of institutional support through ES; those not sanctioned are often ignored or even discouraged. As users enact certain aspects of ES-in-practice, their enactments reify structures of ES-in-practice. It is not a question of limiting their actions, but that of limiting space for users to enact deviant structures. Thus, in this section, we develop propositions based on implications of the nature and use of ES in relation to signification, domination and legitimation from the realm of structures in the structural model.

#### ***Proposition 1.1: The complexities of ES-in-practice induce opacity of action among users.***

Organizations often need to ease ES into use by addressing proper customization of the system and/or assimilation of practices [Markus and Tanis, 2000]. The resultant user enactments create new knowledge boundaries that span new technologies-in-practice, processes and structures [Robey et al., 2002]. Such knowledge boundaries induce opacity of action in users' enactments of ES-in-practice. As we have discussed in Section 5.4, opacity of action implies a low degree of understanding of structures enacted by users through ES-in-practice, which signifies users' inability to change those systems radically due to the interpenetration of structures.

Designing appropriate business process changes along with ES implementation is an important step in achieving management objectives [Ross and Vitale 2000]. Consequently, the resultant new



practices demand extensive learning by users so that management objectives may be achieved [Robey et al. 2002; Holland and Light 1999]. However, users often act within their understanding of past systems, which is illustrated by Robey et al. [2002; Pg. 28]:

With the new ERP, many tried to achieve these results by “beating the system,” a behavior learned during the legacy system years. With their ERP system, however, rewards would come to those who exercised discipline instead of creativity. . . WearCo also recognized this issue and offered incentives to plants that used the ERP system accurately.

Actors are also less in control of the environment under which they enact ES use, largely due to the complexity of ES [Robey et al. 2002; Markus and Tanis 2000]. They also often lack knowledge of the role of ES in the organization [Sumner 2000]. The complexity of ES constrains users’ understanding of the overall strategic value of ES in the organization [Davenport 2000]. ES implementations thus impose boundaries on the knowledgeability of users in enacting ES-in-practice. Eriksen et al. [1999] illustrate the low knowledgeability of users in a case study:

Many end users perceived the ERP system as a filing cabinet in which they simply had to enter data; but they lacked the vision of ERP as a strategic tool for organizational planning and control. They were only concerned about data relating to their own functional area; they did not understand that people in other areas also used ERP data to perform their jobs. Consequently, the data entered were often incomplete or inaccurate.

Discussing another case study, Gattiker and Goodhue [2000; Pg.5] identify similar issues due to users’ mistrust of data from the system:

Really, SAP, even though that’s eventually what the plant’s performance is based on, I don’t really use a lot of the numbers that we’re entering. Number one, they’re not easy to get to. I know my way around the system, but they’re not easy to get to. I don’t trust the numbers that it gives me.

Since ES impose constraints on users’ knowledgeability through their complexity, ES-in-practice induce opacity of action among users in organizations. In other words, such complexity of ES leads to inadequate understanding of ES in the organization, leading to disuse or inappropriate use of ES. Through such incomplete or even misleading communication on the nature and logic of ES use, the structure of signification is affected in ES-in-practice. We thus propose: *The complexities of ES-in-practice induce opacity of action among users.*

**Proposition 1.2: ES-in-practice impose structural contradictions on users.**

ES implementations are complex activities that affect the productivity of organizations [Scheer and Habermann 2000], with periods of low productivity during and immediately after implementation [Hitt et al. 2002]. Users endure a learning period reconciling differences in ES from past business practices, defined as misfits [Soh et al. 2000]. However, users still face pressure to return to normal productivity levels [Orlikowski 2000]. The pressure, from the management to achieve stability in use while learning to cope with ES, is identified as a structural contradiction, given Gidden’s [1984] description of contradictions as divergent interests affecting actors (see Section 5.3).

ES-in-practice may achieve stability through the shakedown phase where users learn to use the system and reconcile differences between the needs of the organization and those that could be met through ES. Larsen and Myers [1999] illustrate the contradiction that may arise in a case study where the organization deemed its system a success as it resulted in reduced manpower through layoffs while the layoffs actually reduced organizational knowledge and affected the use of ES, resulting in failure of the system. The study quotes this comment from a user (Pg. 411):

As users from the company, then, we did not get what we wanted out of the new accounting system, and our requirements were actually quite clearly documented. . . .

After he (a particular member of the project team) left, they seemed to be sidelined on another task, and we then had to deal with X (another person) and say: "Look, we need these. When are they going to be done?" And the deadlines were not met. . . .

Some studies suggest that widespread adoption of similar systems across industries erodes the competitive advantage and uniqueness of organizations [Davenport 1998; Myers 1995]. This is another structural contradiction – ES are adopted to provide a competitive advantage, but it erodes the same in turn. Fan et al. [2000] describe Dell Computer's ES implementation, where the company chose to stop customizing the system after two of their projected five-year customization efforts. Dell eventually opted for component-based ES for better fit between the system and the company's existing business processes. Further, Glass [1998] notes the following about ES:

It is interesting to note that, in an era where it is expected that IS will align itself with the goals of the enterprise, the exact opposite is happening with ERPs – the enterprise must align its processes with those of its chosen ERP!

Thus, there exist contradictory influences on users enacting ES-in-practice. Such ES-in-practice amplify the contradictory influences in the organization. We implicate such influences with the structure of domination since agents are able to use resources to enact a structure suited to their purpose, exercising their power over the resources made available through ES-in-practice. Hence, we propose: *ES-in-practice impose structural contradictions on users.*

**Proposition 1.3: The complex and integrated nature of ES-in-practice disperse contradictions through interpenetration of structures.**

The integrated nature of ES provides opportunity for interpenetration of structures in organizations through ES-in-practice. As we have discussed in Section 5.4, interpenetration of structures is the enactment of multiple structures in the same action system [Poole et al. 1985]. In the enactment of multiple structures, the enactment of one structure may mediate or contradict the enactment of another. In particular, contradictions are the structural disjoints of a system [Giddens 1984]. Contradictions involve divergent interests that affect particular actors. Contradictions also tend to be "fault lines" along which conflicts appear when actors express their discontent. Conflicts, however, need not occur along with contradictions [Giddens 1984].

ES are integrated complex systems that impose constraints through new knowledge boundaries on users. The integration creates an impediment to users through lack of visibility of data and processes. Davenport [1998] reports the paradoxes of changes in organizations due to ES, where centralization is designed for greater flexibility but leads to stifling innovation instead. Reporting a case study, Gattiker and Goodhue [2000; Pg. 7] note the difficulties of this tight integration in ES experienced by a user:

I mean I am not a dumb person, but I have got to tell you I don't understand. And, I was the materials manager in my previous life and I understand MRPII, and I have a financial background as well. All of this (accounting and materials management standard bodies of knowledge) stuff makes good sense to me, but I cannot make sense (of the changes arising from ES implementation)... I mean when a transaction happens over here it is so integrated I don't know what is going to happen with it.

However, this is not the norm for ES-in-practice. Other studies report greater broad-based functional knowledge among users in organizations resulting from ES use [Davenport, 2000; Baskerville et al., 2000]. Hanseth et al. [2001] report greater collaboration across a global organization resulting from ES-in-practice. Askenas and Westelius [2000; Pg. 430] report increased knowledge from ES use:

In one way, the system change was a psychological revolution. You started to understand what you were doing. Today, when you ask them, they actually tell you what

they are up to. . . . They even start to question our initial decision to use the MRP technique for all materials (Purchasing Manager).

ES, due to their complexity, have led to conflicting results from their implementation and use [Markus and Tanis, 2000]. Organizational outcomes thus appear emergent rather than determined or constructed [Besson and Rowe 2001]. Giddens [1999] describes the modern world as a juggernaut which forces its way through enormous force but does yield to collective steering. Similarly, ES are integrated systems constructed with push and pull tensions, and a variety of sometimes-contradictory influences. ES can then be characterized as “composite infrastructures that seem to behave erratically. Such behavior is shown to be caused by the relentless emergence of side effects from the intertwined dynamics of technology and globalization” [Hanseth et al. 2001; Pg.35]. Though there are divergent influences through structures of domination as we have discussed, users attempt to invoke power through the legitimate schemas available to them through ES-in-practice. Hence, user enactments may not overlap contradictory structures through interpenetrating structures, and thus may not precipitate contradictions. Thus, we conclude: *The complex and integrated nature of ES-in-practice disperse contradictions through interpenetration of structures.*

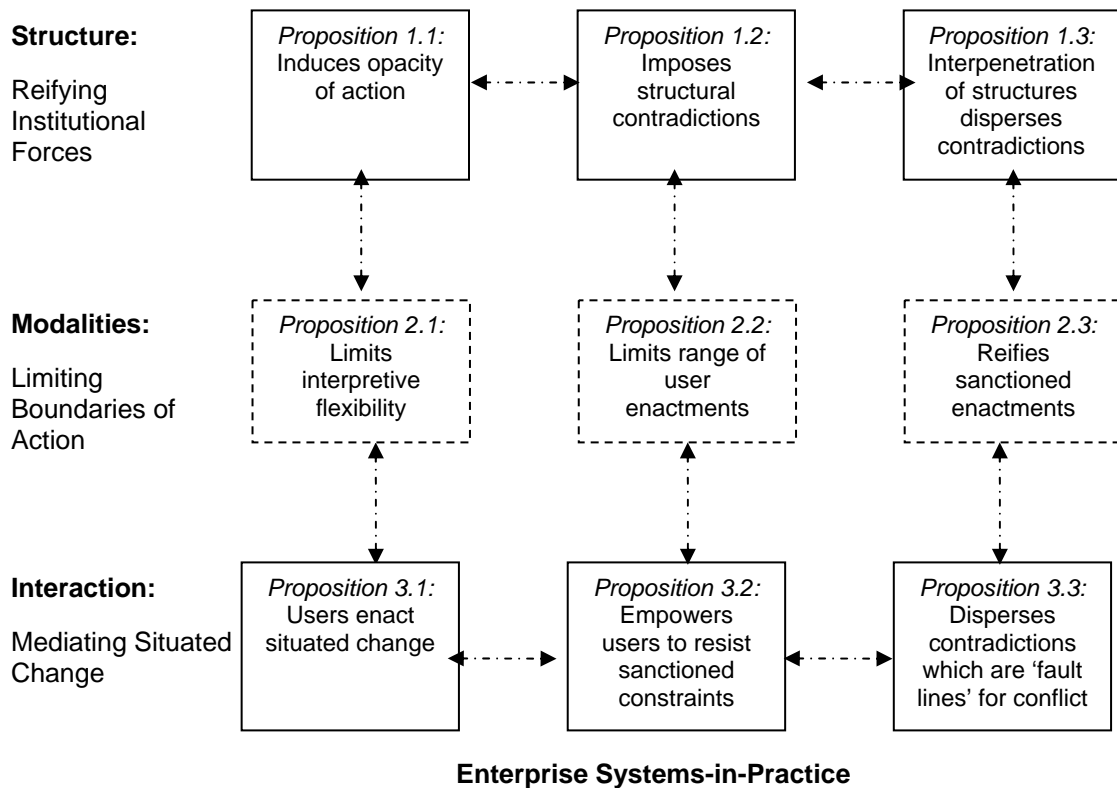


Figure 3. Structural Model of ES-induced Organizational Transformation

**MODALITIES: LIMITING BOUNDARIES OF ACTION FOR HUMAN AGENCY**

Giddens [1984] identifies modalities as the mediation between the realm of structures and human agency. The three modalities (interpretive flexibility, resources, and norms) are means through which human agency understands social phenomena and enacts structures. To act meaningfully within organizations, individuals draw on existing stocks of knowledge, resources and norms to perform their work, often doing so only implicitly [Orlikowski and Robey 1991]. In this section, we discuss the implications of ES-in-practice with respect to modalities.

**Proposition 2.1: The characteristics of ES limit the interpretive flexibility of ES-in-practice.**

The interpretive flexibility of technologies-in-practice is not unlimited; rather, it is constrained by the characteristics of a technology, the characteristics of the humans using the technology, and the characteristics of the institutional context [Orlikowski 2000]. Also, the packaged nature of ES results in a significant time lag between the design and use of the systems. This is of consequences to the ability of users to perceive and utilize flexible interpretations of ES to shape their interaction with technology. Orlikowski [1992; Pg.421] argues that “(the) greater the temporal and spatial difference between the construction of a technology and its application, (the) greater the likelihood that the technology will be interpreted and used with little flexibility”.

It is logical that if users are distanced from technology development, they are less able to comprehend the designer assumptions that are embedded in the functionality of the technology (a material aspect), which in turn limits their use of functions expressed in the software [Kogut and Zander 1992]. Sumner [2000] highlights the lack of user understanding about the role of ES. Milford and Stewart [2000] further emphasize this by stating that the level of user involvement with ES is different from that with traditional large software projects, as users of ES are only involved in customization or configuration. They typically have a negligible impact on the design of ES. Also, those who understand the role and complexity of system maintenance do not play a significant role in the implementation and use of the system [Glass 1998]. Additionally, due to the limited flexibility of ES, users often find workarounds to the system that end up in manual processes or independent systems. Gattiker and Goodhue [2000; Pg. 5] identify one such incident in their case study:

Since FPC's ERP system is part-number driven, the only way to record the exact contents of recovery reclaim would be to assign a part number to every piece that is placed into recovery reclaim. . . . Therefore, all material that is placed into recovery-reclaim is inventoried under a single part number, and SAP only “knows” the total cubic feet in recovery-reclaim. This poor visibility into recovery-reclaim causes problems for the plant . . . keeping a perpetual recovery-reclaim inventory in Excel; however, doing so would require a full-time clerk which the plant cannot afford. The finishing department, too, must do manual calculations in order to manage the material flow into and out of recovery-reclaim each day. This activity consumes about one man-day every day, and the department recently hired a clerk solely to work on it.

Ross and Vitale [2000; Pg. 239] observe similar events in their study:

[ES] resulted not only in new processes, but – paradoxically – in some processes that had once been automated becoming manual. Consequently, resource requirements increased in some areas.

It must be noted, however, ES may overall still deliver savings. In addition to their packaged nature, ES integrate business processes and information across the organization to the degree that they shape the interpretive flexibility of ES-in-practice. As we have noted in the discussion on ES, the extent to which ES are integrated depends on their implementation. The complexity and integrated nature of ES restrict their ability to support idiosyncratic ways of working [Davenport 2000], thus limiting the interpretive flexibility of ES-in-practice. Limited flexibility may also arise for several other reasons such as design, customization, or low data/process visibility. Consequently, users resort to workarounds by beating the system [Robey et al. 2002]. As a result, many studies have called for greater user participation in ES selection, implementation [Holland and Light 1999; Kawalek and Wood-Harper 2002], and user training, in addition to the specification of individual functions [Sumner 2000]. However, users have little control over such issues. The time-space distance between design and use of typical ES further widens this divide. Thus, we propose: *The characteristics of ES limit the interpretive flexibility of ES-in-practice.*

***Proposition 2.2: The highly networked and integrated nature of ES-in-practice imposes material constraints that limit the range of user enactments.***

ES are applications with a high level of interdependency and standardization. Comprehensive implementations typically achieve integration across all the business units of an enterprise while a parsimonious approach entails the selection of certain core modules and is typically limited to a single site [Parr and Shanks 2000]. Another approach is the best of the breed approach, where modules are selected from a variety of vendors to create a system of connected and interdependent enterprise system [Light et al. 2001]. According to Orlikowski [2000], “the more a particular technological artifact is integrated into a larger system, network or technological configuration, the narrower the range of alternative uses that may be crafted with it” (Pg. 409). This is expected due to the high degree of standardization that the artifact may have to meet in order to be integrated with the larger networked infrastructure of the organization. The complexity and integrated nature of comprehensive implementations of ES constrain users’ idiosyncratic ways of working [Davenport 2000].

We have noted that constraints enable as well as impede users. Discussing ES at Norsk Hydro, Hanseth et al. [2001] identify that ES-in-practice play a key role in bringing about integration to the benefit of better organizational performance (Pg. 44):

Tight integration means close collaboration. Close and efficient collaboration requires that those involved be parts of the same community, knowing each other well, and having a shared background, culture and identity. Establishing such a shared “platform” takes time and can only happen through collaboration. . . . Through this process, different units could generate and share ideas about how to improve their own work far beyond what is addressed by the SAP project, and discover new areas where cooperation and integration would be beneficial.

However, constraints can also impede organizations. Hanseth et al. [2001] further note how ES-in-practice could constrain users, resulting in poor performance (Pg. 44-5):

Integration, however, means increased interdependence. This interdependence creates problems in the process of change. The more closely a number of components are integrated, the more changes in one have implications for the others. . . . Accordingly, the bad quality of services related to the support of the Bridge infrastructure also affected the use and usefulness of SAP in a negative way. Because both SAP and Bridge on the one hand, and SAP “processing” and “site management,” on the other hand, were integrated . . . [which] reflexively turned back on itself and caused the overall quality of the IT services to be poor.

The limitations of networked and integrated technologies present a material constraint on users. This is underscored by the high interdependency of such technologies, as well as the idiosyncrasies of various users and their functions. Organizations often attempt to walk the thin line between achieving the benefits of an integrated view of the organization and supporting specific functional competencies and requirements [Davenport 2000; Ross and Vitale 2000; Hanseth et al. 2001]. Such approaches leave organizations placing material constraints on users through greater control while empowering them with ES [Soh et al. 2000]. Hence, following the manifestations of material constraints on the facilities invoked through user enactments, we propose: *The highly networked and integrated nature of ES-in-practice imposes material constraints that limit the range of user enactments.*

Individuals draw on and reproduce structures, often failing to grasp that they are enacting the same phenomena that confront them. An often-cited reason for implementing ES, and the most likely goal to succeed [Connolly 1999], is to standardize coding schemes and procedures across the organization [Markus and Tanis 2000; Ross 1999]. Organizations adopt best practices that have been integrated into prepackaged systems to achieve standardized processes and data formats across their units. This implies that ES impose their own logic on the organization

[Davenport 1998] with the implicit or explicit sanction of the management [Davidson 2000]. ES thus represent a duality where they are influenced by institutional forces, and also serve to preserve institutional rules by constraining human action [Gosain 2004].

ES-in-practice constrain and enable human action along sanctioned patterns of enactments that the organization deems appropriate, though human agency is still capable of enacting varied patterns. Gosain [2004] cites the case of a packaged goods manufacturer that failed to identify the fall in demand for a product line. This was attributed to ES' method of reporting open orders and cumulative order positions, which imposes the vision of the system on users, preventing them from identifying the falling demand. In another study, Volkoff et al. [2005] cite the case of ACRO, where users sacrificed efficiency to achieve the ES demand for accuracy. Users needed to provide data that was previously managed by other departments. Ross and Vitale [2000; Pg.239] illustrate the role of ES-in-practice in demanding users to enact technologies as they are intended to be used:

It is very hard for people to change from things they know well and are good at. We find that the people who were most effective in the old environment were those who knew how to "beat the system." With SAP, beating the system is not good; what's good now is discipline. People have a lot of unlearning to do and it's very painful. (Business Vice President)

By legitimizing sanctioned user enactments, the institutionalizing effect of ES-in-practice further gives a perception of complete lack of user control, which some users reject [Ross and Vitale 2000; Pg. 239]: ". . . no blankety-blank computer is going to tell me how to run my business."

Even when organizations make no specific attempt, ES reflect institutional forces [Sia et al. 2002]. ES-in-practice thus reify sanctioned enactments through their use in organizations. Reification in our discussion takes after Giddens' [1984; Pg. 180] description as a "facticity" with which social phenomena confront individual actors in such a way as to ignore how they are produced and reproduced through human agency." Since such reification impacts the norms that govern user interactions, we propose: *Institutional influences through ES-in-practice reify sanctioned enactments by users.*

### **REALM OF HUMAN ACTION: MEDIATING CHANGE SITUATED THROUGH ES-IN-PRACTICE**

Giddens [1979] views change as episodic. Episodic change identifies periods of change marked by distinguishable events. However, institutional analysis of episodic change assumes the primacy of organizational stability [Orlikowski 1996] while Giddens [1979] considers no value in looking for stability in social analysis. Hence, while ES implementations may be episodic changes in organizations, we suggest that instead of viewing them in terms of stability in organizations, we consider the intermediate periods to be that of situated change due to the continuous enactment of structures in the organization [Orlikowski 1996]. In this section, we consider the impact of human action on change in the organization resulting from ES-in-practice.

***Proposition 3.1: As users cope with embedded processes in ES, users enact situated change through ES-in-practice.***

Organizations are a place of continuous enactment of structures, constituted by the ongoing interpretation and action of its actors [Giddens 1984]. Thus change is inherent in everyday human action and inseparable from the ongoing and situated actions of organizational members; this is often neglected by change theories [Orlikowski 1996]. However, we must note that all theories of change are primarily different descriptions of organizational action [March 1991]. Hence, based on the level of change, we may consider various organizational actions that lead to change as varying in degree rather than as a dichotomy [Goodstein and Burke, 1991]. Therefore, we consider situated change enacted by users through ES-in-practice as similar to "precipitating circumstances" that are stretched over a period of time and which may lead to a fresh episode of change in the organization [Giddens, 1979].

This view of change and ES-in-practice is consistent with Tyre and Orlikowski's [1994] concept of "windows of opportunity," or brief periods corresponding to the introduction of a new technology. Tyre and Orlikowski's [1994] research finds that adaptation to a new technology tapers substantially after the initial activity within a window of opportunity. According to Tyre and Orlikowski [1994], "it appears that further adaptation is rare unless some sort of unusual event or discovery (such as breakdown in the technology, the entry of more new technology, a managerial intervention, or the culmination of users' own frustrations) triggers subsequent episodes of adaptive activity" (Pg. 114). Previous findings by Hedberg, Nystrom, and Starbuck [1976] also indicate that behavioral patterns associated with production tasks congeal rapidly after an initial definition is put in place.

With ES, typically, organizations seeking the benefits of cross-functional information and processes choose minimal customization [Davenport 1998; Nah and Lau 2001; Martin 1998]. Yet, most ERP projects undergo major changes [Robey et al. 2002]. As noted previously, such ES limit the interpretive flexibility of users enacting ES-in-practice. Users, however, still need to resolve differences to comply with the pressure on improving productivity. Gattiker and Goodhue [2000], note in their report on a case where ES did not support the needs of the plant and users had to use spreadsheets to complete their tasks:

Though purchasing uses Oracle, Oracle is not an integral part of manufacturing and materials management. Kanban controls the shop floor, and spreadsheets are used for production and material planning. The plant manager characterized the situation as follows: I would strongly disagree [with the statement 'you are running your plant using Oracle']. We are running our plant based off of our manual systems, and we have simplified Oracle to a point to be able to use it to accurately reflect our financial status.

In the case just cited, the enterprise system was bypassed for transactional activities, and used only to reflect financial status. We may find the reason in that though ES limit interpretive flexibility, users are under pressure to deliver [Hitt et al. 2002]. Such a situation is often resolved through workarounds that users enact in response to their environment [Robey et al. 2002; Ross and Vitale 2000]. Robey et al. [2002] note:

For example, at CommCo, a respondent said that instead of learning the new processes that the firm was trying to introduce, individuals worked to reestablish "how to do what they had done in the past, including workarounds." Another respondent from AutoCo remarked that users were adept at working around the requirements of ERP software. In his opinion, the practice of pulling data off the system for analysis on desktop software instead of querying the ERP database directly was a crucial workaround with potentially disastrous results. "Microsoft is the toughest legacy system to replace," he said.

Such attempts at workarounds often take the form of recreating past processes (organizational memory) or patching with new means to accomplish the task [e.g., Robey et al. 2002]. Such attempts may also eventually be institutionalized through organizational sanctions approving new resources. Thus, we postulate the possibility of creating new meaning through ES-in-practice as follows: *As users cope with embedded processes in ES, users enact situated change through ES-in-practice.*

***Proposition 3.2: ES-in-practice empower users to resist sanctioned constraints.***

The constraining aspects of power are seen as various sanctions. All power relations are related with the acquiescence of the participants involved. Giddens [1984] notes that to say a person has no choice but to act in a certain way implies he values something so much that he acts in that way. In the realm of human action, users may choose to exert their power in various means [Giddens 1984]. Even actors with no apparent power may exercise some power through their refusal to acquiesce to other power relations [Giddens 1984]. Since ES empower users through control over information flow and local decision making to realize any potential benefit, their role

is crucial [Sia et al. 2002]. Also, any user resistance could take several forms within an organization, stemming from inherent contradictions [Ross and Vitale 2000].

Sia et al. [2002; Pg. 34] illustrate resistance from users with a case where hospital nurses attempted to prevent organizational control “by complaining about the unreliable transaction trails of ERP and the compromise of patient care”. Ross and Vitale [2000] report a form of resistance where users did not see the benefits that the management projected, and as a result, resisted the system:

In many organizations, it had become politically incorrect to speak of a technological imperative, so most managers involved in ERP implementations talked instead of how the system would “enable” change. However, the daily experience of persons actually using the system was that a computer was dictating how they would do things.

ES are large complex systems that seek to standardize processes across organizations. Even with the best of breed approach, packages are configured to share databases and leverage the streamlining of processes across different functional units. It is no surprise that such complex systems contain contradictions, as discussed previously. However, when such contradictions provide a unified theme, they create opportunities for conflict [Giddens 1984]. However, as a constraint, ES-in-practice do empower users in some ways since all constraints both empower and constrain users. Through human action, such power relations affect the potential for change in the organization, thus empowering users through ES-in-practice. We must note though, that all human action has both intended and unintended consequences [Giddens 1984]. Hence, we summarize this aspect of power relation in the following proposition: *ES-in-practice empower users to resist sanctioned constraints.*

**Proposition 3.3: The contradictions dispersed through ES-in-practice represent fault lines for potential conflict.**

As we have discussed, Giddens [1984] identifies contradictions as fault lines along which conflicts may appear. Dispersed contradictions in ES, in conjunction with various contextual factors may potentially lead to conflicts. However, such contradictions become conflicts only when they find a unifying theme [Giddens 1984]. When organizations attempt to leverage standardization across the entire organization, such dangers of conflict are high [Markus and Tanis 2000]. Though problems that occur during use of ES are often related to issues that have been left unresolved or unnoticed during the project [Markus and Tanis 2000], ES-in-practice give form to such unresolved issues. However, as discussed previously, these issues are usually dispersed through ES-in-practice.

We now consider the issue of fit between ES and organizational processes. Both Davenport [2000] and Talbert [2002] argue that business benefits from ES can only be achieved through a tight fit between organizations and ES. However, they also note the elusiveness of the “perfect fit,” arguing that some degree of compromise is necessary. Their argument echoes prior statements in the ES literature [Spratt 2000; Light et al. 2000]. Fit, then, is an approximation; different organizations manage to obtain different degrees of fit between their existing institutional rules and the best practices inherent in ES. In those organizations that achieve a closer fit between the two, there is a small, if negligible, discrepancy between existing institutional modalities and those mediated by ES. Organizations typically trade off fit for quick relief from outdated legacy systems or pressing technical problems [Davenport 2000]. Institutional memory and ES-in-practice become conflicting sources of modalities potentially resulting in multiple legitimate interpretative schemes.

Following from Proposition 2.3, where we argued that ES disperse contradictions through ES-in-practice due to its highly integrated and complex nature, we now suggest that through human action, such contradictions may overlap and precipitate into conflicts. Volkoff et al. [2005] cite the case of ACRO, where designers had to detail how to assemble components in ES years before they ever needed to consider such issues. Moreover, as we have noted, ES emphasize accuracy



over productivity in organizations, and could lead to conflicts when the pressure on improving productivity increases. Such situations are also causes for considering the migration of ES, particularly when there are no means to resolve the issues adequately [Kremers and van Diesel, 2000]. Scott and Vessey [2002] in their analysis of FoxMeyer's failed ES project note that employees failed to report widespread problems with the system, which culminated into a disastrous result for the company. A consultant to the project is quoted as saying (Pg.79):

Every time we showed something that didn't work, they'd say, "Is this a deal breaker?" Well, no one was a deal-breaker. But if you put enough cinder blocks in a rowboat, it's going to sink.

Hence, sanctioned structures that are contradictions enacted by users may overlap, and may be summarized as follows: *The contradictions dispersed through ES-in-practice represent fault lines for potential conflict.*

## VII. DISCUSSION, IMPLICATIONS AND LIMITATIONS

### THEORETICAL IMPLICATIONS

#### Enterprise Systems Use

The primary contribution of this paper is to research the change induced by ES use through the development of a conceptual model grounded in structuration theory. ES use in general has been neglected in academic research, and in particular, its impact on users [Holland and Light 2001]. This paper thus differs from the extant ES literature, which focuses on change resulting from the implementation of ES [for example, Volkoff 1999; Davenport 2000; Somers and Nelson 2001, Robey et al. 2002]. We place ES use within its context by illustrating how the fit between the existing institutional environment and ES impacts the structuring elements of ES-in-practice. In doing so, we address the major limitation of current IS research described by Avgerou [2001]: "...great deal of effort in information systems research has been directed toward developing general knowledge for the implementation of information technology innovation without considering in a systematic way variations of the organizational and broader context in which the innovation is embedded" (Pg. 43).

Organizations do not exist outside the enactment of structures by its members. Through structuration theory, we study the impact of ES on several influences. ES propagate perceptions of constraint among users [Cadili and Whitley 2005], which confront users with such facticity as to create opacity of action for them. This is due to limitations in interpretive flexibility imposed by ES through integrated, multiple and sometimes contradictory structures that create a structural constraint. Actors draw on these modalities, and through ES-in-practice, enact situated change. The potential for conflicts and change still persists through the power bestowed by ES-in-practice on users, however limited it may be. Such a perspective retains the reflexivity of human action, and the enabling and constraining nature of ES-in-practice. It also illustrates the working of the model, where a variety of influences act on human agency, resulting in potentially varied behavior. Overwhelming evidence from the ES literature suggests that the constraining nature of ES influences human action, tying them to institutional forces [Gosain 2004].

#### Change in Organizations Induced by ES Use

Structurational analysis of ES enables us to differentiate the dynamics of change occasioned by ES. Specifically, the distinctive characteristics of ES-as-artifact (such as their complexity and integrated nature) are implicated when structuration is used to explain the effects of ES on the modalities of structuration and the patterns of interaction that mediate the institutionalization of structures. In stating that ES-in-practice can, over time, concretize institutional rules, we imply that the locus of future sources of change shifts to organization-level and external factors, including firm strategy and stage of life cycle, changes in environmental conditions, and the advent of new technologies.

In particular, through the reinforcement of several contradictions into a unifying theme, the importance of human action is still given primacy. Our model highlights that the constraining nature of ES affects the ability of human agency to realize its potential to change. Further, through ES-in-practice, agency enacts emergent behavior in ES use, situating any change in response to the context. Such changes are constrained and of low magnitude. These situated changes can be identified with Giddens' [1984] notion of precipitating circumstances that lead to a clear identification of episodes of change. In the ES context, where user dissatisfaction or situated changes unify towards a greater organizational issue, the management may plan a migration in response, for example. The migration exercise itself may then be considered an episode of change.

### **MANAGERIAL IMPLICATIONS**

The notion of ES as sanctioned influence on users is of consequences to managing users. The management has to educate users on the role of the entire system in the organization [Sumner 2000]. Such training helps disperse contradictions that users perceive through limited access to ES. Also, given the importance of user interpretation, ensuring consistency and standardization is important. However, greater standardization often causes conflicts [Markus and Tanis 2000]. Thus, the federalist alternative, as described by Davenport [2000], should no longer be associated with different ES software across locations/business units; rather, the implication of our research is that the same software needs to be implemented across the organization, with careful attention to what remains uniform versus what can be tailored across multiple sites. In short, the choice of customizations should ensure that contradictions or inconsistencies are sufficiently dispersed to prevent conflicts.

Considering the situated change enacted through ES-in-practice, organizations should carefully manage enactments by providing relevant resources and training. However, while the support may provide competitive advantage by allowing for user idiosyncrasies, the project can also run out of control and spiral into a disintegration of the entire system [e.g., Hanseth et al. 2001]. The contradictions discussed in this model highlight the ever-present potential for such possibilities in organizations. Hence, organizations need to show greater care in managing emerging enactments by users. Due to the limitations on modalities highlighted by the paper, managers may need to devise training schemes that demonstrate the ethereal nature of ES in the organization. Further, the paper also highlights the need for managers to devolve control and allow greater participatory role for users in effecting the use of ES. In summary, contrary to the view of ES as centralizing control, ES should be empower proactive users in the organization.

The limited potential of future change as a consequence of constraints through ES-in-practice is also of implications to the role of the middle management of an organization. In controlling the sources of change within the organization over time, ES shift the focus of managers' attention to external factors that could possibly occasion organizational change. Middle managers' roles morph from supervision and information relay to strategic decision making based on environmental conditions. This hastens the advent of what Drucker [1988] refers to as the "new organization," which is characterized by flatter hierarchies and knowledge specialization. With the number of middle management levels drastically reduced either with the promotion of middle managers to higher levels or with the elimination of certain levels altogether, top managers need to seriously consider the issues regarding the supply and preparation of future generations of top managers [Drucker 1988].

### **FUTURE RESEARCH IMPLICATIONS**

The analysis in this paper opens up many avenues for future research. Primarily, this study highlights the need for more empirical studies on ES use. Though there are numerous descriptive studies currently [Davenport 1998], they focus more on implementations of ES. This paper explores the role of ES-in-practice, and notes that the artifact itself requires much research too. While IT artifacts are under-theorized [Orlikowski and Iacono 2001], many studies assume embedded characteristics of the artifact without distinguishing the artifact from its enactment.

Along these lines, further investigation is required into the nature of ES-as-artifact, and their influence on ES-in-practice. Such an analysis may provide further insights into the constraints and conflicts in ES use.

Since users enact situated changes, it now becomes necessary to investigate the critical success factors of ES use since several issues that affect the use of ES may be traced to issues of implementation [Markus and Tanis 2000]. Investigating the relationship of such factors may be crucial to managing both ES implementation and use. For instance, a decrease in the importance of change management as a critical success factor associated with ES use would validate the proposition that ES use limits internal change.

The interaction of various forms of contradictions and their impacts on the use of ES are another significant area for research stemming from our work. Such contradictions may cause resistance [Sia et al. 2002] or push ES out of organizations' control [Hanseth et al. 2002]. Structuration theory provides a suitable mechanism to explore the identification and study of the interaction effects of human agency. Exploring each of our propositions may provide insights into the nature of ES use and the constraining impacts of ES on changes enacted by users. Finally, it would be interesting to study the contradictory outcomes of ES use through our proposed model identifying the nature and source of influences in outcomes of ES-in-practice.

### **LIMITATIONS OF THE STUDY**

Despite growing interest in ES, researchers have largely focused on the implementation of such systems in organizations [Esteves and Pastor 2001]. This paper is an attempt to focus on the impacts of post-implementation ES use on organizations. However, this paper relies on secondary data that has been extracted from selected qualitative journal articles. Hence, the paper potentially suffers from the absence of primary data and post-implementation stable use periods in organizations. However, we believe this paper still contributes towards organizing an exploratory discussion on the impacts of ES use. Further, due to the examination of problematic themes in ES in the secondary data set, the propositions identified in this research may be construed as painting a negative picture on the use of ES in organizations. Organizations do benefit from the use of ES, and its consequent impacts on the working of the organization. However, this paper focuses on the impact of ES use on the change processes in the organization. Further, the resultant impacts on the change processes presented in the structurational model may not be generalized as negative impacts of ES use. Further research is obviously needed in this area, and this paper is an attempt to identify potential for such research efforts. In particular, this paper echoes the demand for longitudinal ES use data that is needed to completely understand the impacts of ES use in organizations [Hitt et al 2002].

### **VIII. CONCLUSION**

This paper has proposed a theoretical understanding of the role of ES use in inducing change within an organization. The enactments of ES-in-practice situate change in organizations. Through enactments of technology use, we are able to analyze ES use with structuration theory. Using structuration theory as a sensitizing device [Giddens 1984] helps identify various influences on socially constructed ES-in-practice and relate them to organizational change. Given the scarcity of studies on ES use, and the need for theoretical models on the impacts of ES on organizations [Holland and Light 2001], our research helps bridge the research gap. The resultant structurational model of ES-in-practice is of implications for both practitioners and researchers.

ES attempt to standardize and homogenize the activities of agency in an organization in order to focus on improving productivity. The nature of ES differs from that of other information systems, requiring a fresh look at the impact of ES on organizations and change. ES implementation is a complex and difficult task and much research has focused on this aspect. However, ES use is also a complex activity fraught with difficulties. Users constrained in various ways within the organization enact situated change. Such situated enactments of change precipitate constraints

and contradictions, leading to episodes of change in the organization. Through an improved understanding of the various issues we have discussed, we believe further empirical research can contribute to better use of enterprise systems.

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#### APPENDIX A: SELECTED SECONDARY DATASET

Citation	Description	Research
Larsen and Myers, 1999	The paper examines the changes introduced during an implementation of ERP. The implementation was deemed "success" at project completion, but was soon identified as a failure due to long-term implications on the organization.	Case study of a financial services company in New Zealand, studying its BPR and ERP implementation.
Soh et al, 2000	The study identifies types and impacts of misfits between the system and practices due to ERP implementation, and how organizations resolve such misfits.	Examines the implementation of ERP in a hospital in Singapore. Data collected through interviews and observations.
Davidson, 2000	Examines the organizational consequences of implementing clinical information systems, focusing on interpersonal communication and social interaction issues.	An in-depth case study at a private non-profit acute care hospital providing range of primary and specialized care services.
Kremers and Diesel, 2000	Examines customer and vendor viewpoints on migration of ERP systems in organizations.	Interviews conducted with vendors and customers.
Hanseth et al 2001	This study discusses the implementation of ERP in the context of modernization and globalization. The ERP system provided momentum for organizational transformation, but soon became an obstacle for further change in the organization.	Case study of an ERP implementation in an organization in Europe. Data collected through 25 interviews, follow-up conversations and secondary data.
Robey et al, 2002	The study of 13 organizations identifies knowledge barriers in assimilation of ERP. The study also identifies approaches by organizations in addressing such knowledge barriers.	Comparative case study across 13 organizations with completed ERP implementations.

Ross and Vitale, 2002	This paper discusses findings on generating business value from ERP implementations in organizations. The study identifies some critical success factors in generating business value from ERP implementations.	Data reported in this paper is collected from 40 interviews conducted with 15 organizations. The interviewees were drawn from the managers sponsoring and managing the implementation, and executives heading the functions affected by the implementation of ERP.
Lim, Pan and Tan, 2005	Examines the utilization of SAP implementation from users' expectancy perspective	Participative Action Research, focusing on users during GlobalMNC's SAP implementation.
Volkoff et al, 2005	Examines phased ES implementation, exploring the interdependence of process and data. Identifies integration opportunities and problems in organizations using ES.	3-year longitudinal case study of Phased ES implementation.

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